

An Integrated Approach in Characterizing Depositional Facies Using Seismic and Well Penetration Data: A Case Study from Saudi Arabia

Khalid Aljoaib

Saudi Aramco

Abstract

The study focuses on the Middle Jurassic formation in the Oxfordian succession. Core, well logs, and seismic data were used in this study as an integrated model to characterize depositional facies of the middle Jurassic formation within the Oxfordian reservoir. The result of the study shows the depositional facies distribution of the carbonate ramp model in the study area. The tops of the Oxfordian and the Callovian reflectors were interpreted. Petrophysical calculations were made based on cutoffs determined from core-log calibration to create a first-pass gross depositional environment (GDE) map. A second pass GDE map was generated by refining the initial GDE map based on seismic volume and interpreted surfaces' attributes. Seismic attributes of RMS amplitude, Sweetness and RGB Spectral decomposition were used in the study. Based on the integrated study, the model of the study area is a carbonate ramp with basin, outer ramp, middle ramp and inner ramp depositional settings. Facies changes across the study area from organic rich mudstone to wackstone-packstone to grainstone with changing grain size from very fine-fine to coarse grains with good porosity. Seismic amplitude changes from high amplitude which is associated with source rock in low energy basin settings, to intermediate amplitude which is associated with outer ramp to low amplitude which is related to high energy inner ramp. The middle ramp (between the inner and outer ramp) is in shallow marine high energy shelf margin settings with low risk in petroleum system elements which includes good reservoir quality with coarse grains and relatively high porosity. Results from the petrophysical logs, seismic attributes and core support the same facies distribution outcome and confirms the presence of good porosity facies in the middle carbonate ramp.